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EVIDENCE OF TWO PRE-MORAINIC GLACIAL MOVEMENTS.[1]

BY G. D. SWEZEY, DOANE COLLEGE, CRETE, NEBRASKA.

THE valley of Rock River, running southward through southern Wisconsin and northern Illinois, is a very deep pre glacial erosion gorge, cut through Lower Silurian rocks and filled with assorted, incoherent glacial sands and gravels. Artesian wells go down several hundred feet through these gravels before striking rock. The region lies to the south of the great terminal moraine.

Along the bluffs of this valley, at various points, there is exposed a conglomerate, composed also of glacial gravels; it is a pudding stone, thoroughly indurated, so as to make an excellent rock for cellar-walls and the like; in some cases it is cemented together by a calcareous matrix, in other cases there is a large percentage of iron hydroxide in the cementing material.

I have long known some of these outcrops, and have been puzzled by them; but have supposed that they were due to local causes affecting the gravels which everywhere fill the broad valley; but some more careful observations this summer reveal these facts:—

1. They rise, in every case that I have observed, ten to twenty feet above the river bottoms.

2. They are overlaid in some cases by the boulder-clay, containing unassorted, striated pebbles.

3. They occur, so far as I can discover, and I am pretty familiar with the region, which was my native county, only on the extreme edge of the bluffs overlooking the broad river bottoms, or on the bluffs of valleys of some width which were tributaries to the main valley when its latest bottoms were formed. They appear, in other words, to be remnants of older gravels which once filled the valley, but were mostly cut away by the floods which deposited the later, unconsolidated gravels now filling the valley and constituting its flood-plain at a level of ten to twenty feet below the top of the conglomerate. In one place the extreme face of the bluff, immediately below an outcrop of the conglomerate, was made up of layers of the light-colored, incoherent gravels, alternating with dark, iron-stained material, evidently derived from the older conglomerate, which then formed the bluffs against which the stream washed.

This distinction of age is confirmed by the occurrence of the ground moraine of the latest glacial movement in this region, overlying the consolidated gravels.

There is no decisive evidence that the interval between these movements was one of great duration, but the striking contrast in appearance between the loose gravels and the conglomerate tends to impress one with the idea that the latter is relatively very old. So striking is this appearance, that at one exposure which I visited I found the owner of the field laboriously digging up an outcropping mass of this conglomerate, somewhat harder and redder than usual, under the supposition that it was a meteorite, which he purposes to take in to Chicago next year for an exhibit.

A further consideration, which would seem to imply a considerable interval between the two movements, is that the following succession of events would seem called for to explain the facts: —

1. A glacial movement bringing the material of which the conglomerate is composed, and which includes about the usual proportion of local and remote ingredients.

2. A melting of the ice and floods, surpassing in extent those of the later epoch, for the conglomerate, as before stated, lies regularly at a higher level than the later gravels.

3. Another forward movement of the ice to account for the ground moraine overlying the conglomerate; and

4. Another melting of the ice to deposit the later gravels.

[1] Paper read before the Nebraska Academy of Sciences, Dec. 27, 1892.

SOME NOTES ON LIGHTHOUSE APPARATUS.

BY J. KENWARD, C.E., F.S.A., BIRMINGHAM, ENGLAND.

IN 1851, the United States possessed four sea-lights on the dioptric system. In 1891 the number was of sea-lights 138, of harbor lights 526, in addition to about 100 of the small apparatus called range-lenses and lens-lanterns.

This magnificent progress in forty years reflects the highest credit on the Government and on its nautical and engineering officers. Under official auspices in 1851, a most exhaustive enquiry was promoted into the merits of the dioptric or refracting system of lights of Augustin Fresnel in comparison with the catoptric or reflecting system which it had begun to supersede. The result having been ascertained to prove a sevenfold superiority for the dioptric system, the government authorized the lighting of the United States coast-line on an imposing scale, and it has ever since taken a watchful and intelligent interest in the advancement of lighthouse science, and in the gradual provision of the best forms of optical and mechanical apparatus.

The steps of progress, indeed, in lighthouse design and construction have been many and important. The first home of this industry was in France, where the illustrious mathematician and physicist to whose practical genius the lenticular system is due, lived his short life, dying in 1827. The celebrated Tour de Cordouan, at the mouth of the Garonne, was the first lighthouse to receive the new installation of his lenses. The names of Leonar Fresnel, brother of Augustin, of Soleil, Letourneau, Lepaute, Sautter, Barbier, Degrand, Allard, Reynaud, Bourdelles, Bernard, and others follow in brilliant succession in France, as engineers, constructors, or contributors to the literature of the subject; while in the United Kingdom the great family of the Stevensons, Mr. James Chance, Dr. John Hopkinson, Sir James Douglass and Mr. Wigham of Dublin, may be cited as equally distinguished.

Nor have the authorities of the United States, while availing themselves fully of the labors and researches of all these experts, been backward in adding American names to the list of honor. To mention only three, General Alexander, Major George Elliot, and Major D. P. Heap are worthy, in their special work, of the country of such men of science as Professor Henry and Professor Newcomb.

It is particularly to Major Heap of New York that credit is due not only in selecting the most novel and striking forms of apparatus produced in Europe, but also in promoting the design and construction in the States, of the lanterns, lamps, clockwork, pedestals, etc., which are indispensable to it. Major Heap is the author, too, of an excellent compilation on lighthouses.

Let me glance at some of the past achievements and present resources of lighthouse science.

During the past ten or fifteen years the great extension of commerce, the opening of new ports, the multiplication of steam vessels of all classes, and the striking acceleration of their speed, have affected lighthouses and lightships in the three essential points of number, power, and distinctiveness. The chief maratime countries of the world — the United States, Great Britain and her colonies and dependencies, France, Holland, Italy, and Denmark, have endowed their coasts with an impcsing array of